PB85-917008

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

HAZARDOUS MATERIALS SPECIAL INVESTIGATION REPORT

HAZARDOUS MATERIALS RELEASE MISSOURI PACIFIC RAILROAD COMPANY'S NORTH LITTLE ROCK, ARKANSAS RAILROAD YARD DECEMBER 31, 1984

NTSB/SIR-85/03

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NTSB/SIR-85/03	PB85-917008	

4. Title and Subtitle Hazardous Materials Special Investigation Report — Hazardous Materials Release Missouri Pacific Railroad Company's North Little Rock, Arkansas, Railroad Yard, December 31, 1984

5. Report Date
September 4, 1985

6. Performing Organization Code

7. Author(s)

8. Performing Organization Report No.

9. Performing Organization Name and Address

u5
National Transportation Safety Board
Bureau of Accident Investigation
Washington, D.C. 20594

10. Work Unit No.
4149-A

11. Contract or Grant No.

12. Sponsoring Agency Name and Address

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20594

13. Type of Report and Period Covered

Hazardous Materials Accident Report
December 31, 1984

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

About 4:45 a.m., c.s.t., December 31, 1984, a switchman discovered ethylene oxide leaking from a tank car in the Missouri Pacific Railroad Company's automatic retarder classification railroad yard at North Little Rock, Arkansas. Railroad officials, fearing an explosion, evacuated the yard and formulated plans to transfer the remaining ethylene oxide to an empty rail tank car. At 3:15 p.m., in anticipation of the arrival of the equipment to transfer the ethylene oxide and concern about the tank car rocketing should ignition occur, the evacuation was expanded to include an estimated 2,500 persons within a 1-mile radius of the leaking car. All rail and highway traffic within the evacuated area was stopped with the exception of traffic using Route 67-167 located in the extreme northwest quadrant of the evacuated area. After the transfer, the residual ethylene oxide was purged from the tank car with nitrogen, and the evacuation was terminated at 11:25 a.m., on January 1, 1985. There were no injuries or fire.

17. Key Words
Railroad yard; hazardous materials; emergency preparedness; tank cars; insulation jacket; anti-shift bracket; emergency guidelines; emergency response; through-wall cracks; tank car committee; degelation of authority.

18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	27	

NTSB Form 1765.2 (Rev. 9/74)

CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

HAZARDOUS MATERIALS SPECIAL INVESTIGATION REPORT

Adopted: September 4, 1985

HAZARDOUS MATERIALS RELEASE MISSOURI PACIFIC RAILROAD COMPANY'S NORTH LITTLE ROCK, ARKANSAS, RAILROAD YARD DECEMBER 31, 1984

SYNOPSIS

About 4:45 a.m., c.s.t., December 31, 1984, a switchman discovered ethylene oxide leaking from a tank car in the Missouri Pacific Railroad Company's automatic retarder classification railroad yard at North Little Rock, Arkansas. Railroad officials, fearing an explosion, evacuated the yard and formulated plans to transfer the remaining ethylene oxide to an empty rail tank car. At 3:15 p.m., in anticipation of the arrival of the equipment to transfer the ethylene oxide and concern about the tank car rocketing should ignition occur, the evacuation was expanded to include an estimated 2,500 persons within a 1-mile radius of the leaking car. All rail and highway traffic within the evacuated area was stopped with the exception of traffic using Route 67-167 located in the extreme northwest quadrant of the evacuated area. After the transfer, the residual ethylene oxide was purged from the tank car with nitrogen, and the evacuation was terminated at 11:25 a.m., on January 1, 1985. There were no injuries or fire.

INVESTIGATION

The Accident

Events Preceding the Accident.--Tank car RAIX 7033 was loaded with 20,066 gallons of ethylene oxide by Union Carbide Corporation (Carbide) at Taft, Louisiana, on December 21, 1984. After completing the loading of the tank car, which had a gross weight of 220,300 pounds, the loader completed a freight car inspection form on which he was required to state general information on the condition of the tank car; he noted on the form that the tank car was in "Good Cond." The loaded tank car was offered to the Missouri Pacific Railroad Company (MoPac) the following day for movement to Syntex Agribusiness in Verona, Missouri. The tank car was routed from Taft to Hope, Arkansas, where MoPac was to interchange the car to the Burlington Northern (BN) Railroad, the delivering carrier.

MoPac took charge of the tank car and moved the car to Avondale, Louisiana, 17 miles south, on December 22. On the following day, the car departed Avondale northbound and arrived in Reisor, Louisiana on December 24. The tank car was moved from Reisor to Longview, Texas, on December 26. The tank car departed Longview on December 27, and arrived at Texarkana, Arkansas on December 28. The tank car departed Texarkana on December 29 and passed through Hope, Arkansas, en route to North Little Rock, Arkansas, where it arrived on December 30. (See figure 1.) Federal regulations required the car to be inspected at its point of origin and each time it was placed in a different train. (See appendix B.)

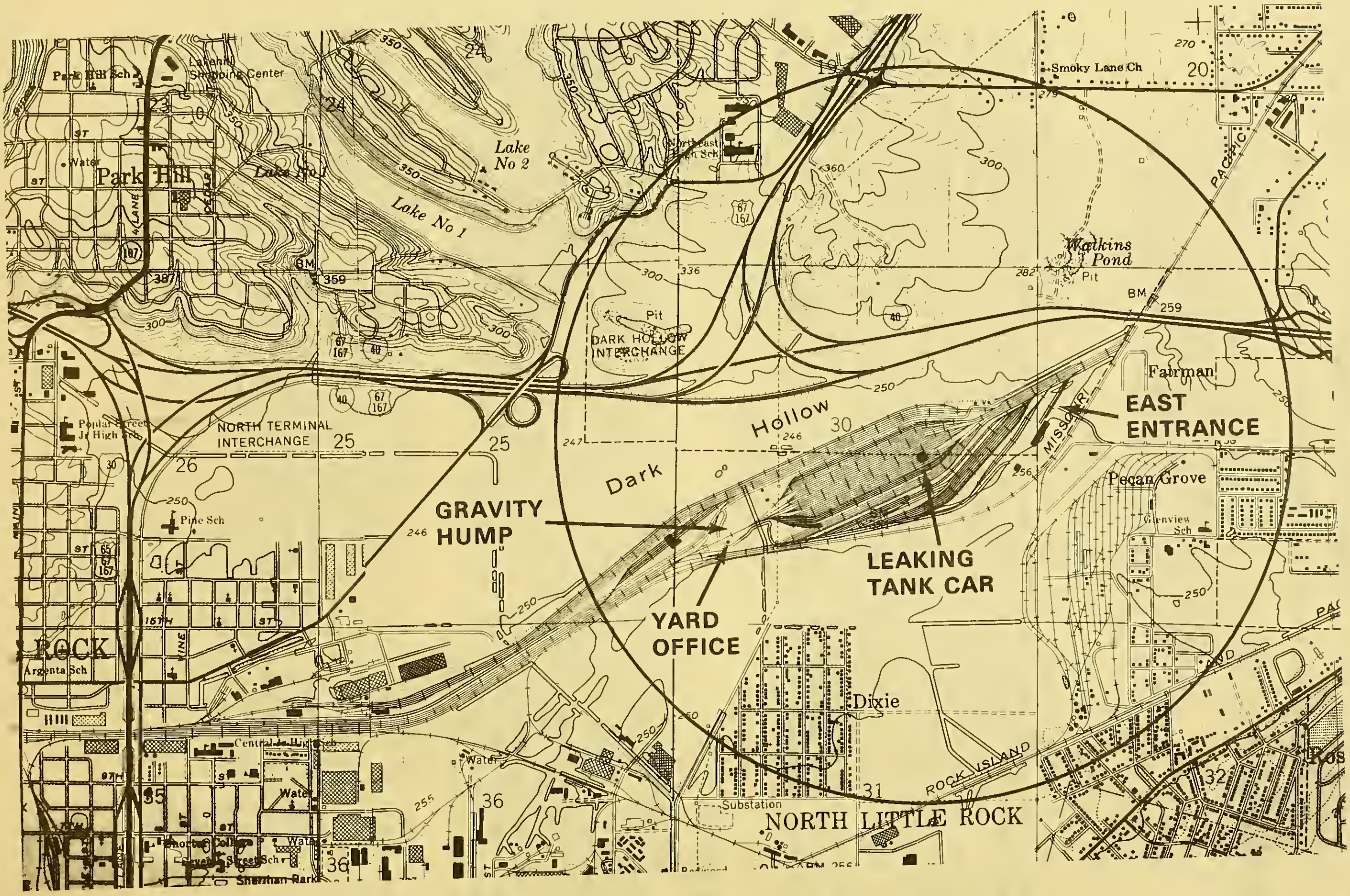


Figure 1.--Area evacuated around RAIX 7033.

At 9:59 p.m., on December 30, 1984, the tank car was uncoupled in motion at the crest of the gravity hump 1/ in MoPac's automatic retarder classification railroad yard at North Little Rock. The tank car passed through the hump's master and group retarders 2/ which reduced its speed; it then accelerated to a speed of 12.04 mph as it moved down the descending grade into classification track No. 5. The tank car reached 12.04 mph, before it began decelerating and rolled about 1,210 feet (22 rail car lengths) and coupled with eight standing loaded covered grain hopper cars and three other cars which were chocked with skates. 3/ The impact of the coupling drove the first of 11 standing cars rearward approximately 55 feet (1 rail car length). The humping operation is controlled by a computer which also controls the speed of the cars being humped.

At 2:40 a.m., on December 31, 1984, box car NW 160155, loaded with rayon crates and having a gross weight of 122,500 pounds, was uncoupled in motion at the crest of the gravity hump and passed through the hump's master and group retarder which reduced its speed. The box car, the last car placed on this track, accelerated to a speed of 13.78 mph as it moved down the descending grade into classification track No. 5. The car reached 13.78 mph, before it began decelerating and rolled about 1,210 feet (22 rail car lengths) to couple with the standing tank car RAIX 7033.

Tank Car Leakage.--About 4:45 a.m., a MoPac switchman who was walking along classification track No. 3 noticed a leak in tank car RAIX 7033 which was on track No. 5. He stated that he saw a vapor cloud and heard a noise that sounded similar to falling water. When he reached the side of the leaking tank car that was placarded "Flammable," he held the tank car safety rail in one hand and an electric lantern that was not approved for flammable vapors service in the other hand. He then knelt beside the leaking tank car and observed liquid flowing from the tank car onto the ground. He radioed his observation to the yardmaster who instructed him to remove the cars from classification track No. 3.

After the yardmaster instructed the switchman to continue with his work, the yardmaster notified the assistant superintendent of the release and simultaneously entered the car number furnished by the switchman into the computer. The computer then printed a listing of the contents of the car and the Association of American Railroads' (AAR) emergency response information for ethylene oxide. (See appendix C.) The assistant superintendent then instructed the yardmaster to keep yard personnel away from the leaking tank car. A computer check was made of the freight cars in the vicinity of the leaking tank car to determine their contents; no other cars carrying hazardous materials were in the immediate area. Switching operations of cars into the group of tracks containing the leaking tank car were stopped. Because the general car foreman was better qualified in the use of self-contained breathing appartus (SCBA), the assistant superintendent telephoned the general car foreman at his home about 5:00 a.m., and requested that he report to the classification yard to inspect the leaking tank car. At 5:10 a.m., the general superintendent's office, which was located at the opposite end of the yard, was notified of the leaking tank car. At 5:15 a.m., the general superintendent's office called CHEMTREC, which in turn notified Carbide. Carbide contacted DSI (a trucking contractor) in Memphis, Tennessee, and ordered a tractor semitrailer with a pump and hose suitable for ethylene oxide service and also notified its Linde Division and requested a tractor semi-tank trailer of liquid nitrogen.

1/ Gravity hump--An elevated section of track in a railroad yard used to roll uncoupled freight cars down a descending grade while making up trains.
2/ Retarder--A device built into the track surface on the descending grade of a gravity hump that is used to reduce the speed of freight cars so as to accomplish a coupling speed of 4- to 6-mph.
3/ Skates--Portable freight car wheel chocks that fit atop the rails and prevents the cars from rolling out of the other end of the track.

Shortly afterward, the general car foreman arrived at the yard. Using a SCBA, the general car foreman walked into the classification yard, confirmed the leak, and reported his findings to the assistant superintendent at about 5:50 a.m. The assistant superintendent then issued instructions to shut down the yard. Using the telephone, radios, and the intercom, the yardmaster and general car foreman relayed an evacuation order to the estimated 75 railroad employees working in the yard. To reduce the sources of ignition, all diesel electric locomotive units, vehicles, natural gas supplies and nonessential electricity were shut down temporarily. Local MoPac officials, using a computer, located a nearby empty tank car that could be used to transfer the remaining ethylene oxide from the leaking tank car and had it moved to the yard. At 6:10 a.m., MoPac's manager of hazardous materials and environmental protection in St. Louis, Missouri, was notified.

Emergency Response

At 6:23 a.m., the general car foreman telephoned the North Little Rock Fire Department and advised it of the situation. The fire department district chief on duty ordered station No. 4 to respond to the west end of the yard. The district chief proceeded to the scene and at 7:13 a.m., instructed engine No. 1 to respond. At 7:30 a.m, the fire department chief and fire marshal were notified. During this time, MoPac special agents blocked the entrances to the yard. When fire department personnel arrived, they were escorted by a MoPac vehicle to the yard office at the crest of the hump. (See figure 2.) The fire department established a command post at the west end of the yard, but it was later moved to the yard office at the crest of the hump. A short time later, fire department personnel stationed additional firefighting equipment at the east and west entrances to the yard.

Fire department personnel tested three fire hydrants in the yard. The first hydrant tested had no water (it had been disconnected earlier from the water main because of construction). The second hydrant had less than 1 pound of water flow pressure, and the third hydrant, which was an estimated 1,875 feet from the leaking ethylene oxide tank car, had less than 10 pounds of water flow pressure. The fire chief stated that the low water pressure was insufficient to supply water through firehoses. To lay firehose to the leaking tank car from any of the fire hydrants, it would have been necessary for the firehose to cross many railroad tracks, some of which were occupied by freight cars. The nearest road was about 437 feet from the leaking tank car, and 21 railroad tracks were between the road and the leaking tank car, with most of the tracks occupied with freight cars. (See figure 2.)

MoPac had positioned personnel with company radios in the area of the firefighting equipment so fire department officials could communicate readily and directly with MoPac officials; however, the radios were not fully utilized because MoPac officials failed to make their purpose clear to fire department personnel for several hours after the fire department arrived. Fire department personnel stated that during the initial stages of the response they experienced several problems communicating with MoPac officials because the fire departments radios were on a different frequency than MoPac radios. MoPac indicated that it was unaware of any problems in communications with the fire department during the early stages of the emergency. Fire department officials reportedly did not take part in some of the decisionmaking process because they were not able to receive the radio transmissions between railroad officials. On several occasions, fire department personnel had to drive to the yard office to talk to MoPac officials.

To monitor the extent of the migration of the ethylene oxide vapor, fire department personnel borrowed an atmosphere analyzer from MoPac because the fire department's analyzer was designed only to detect hydrocarbons. MoPac officials estimated that the

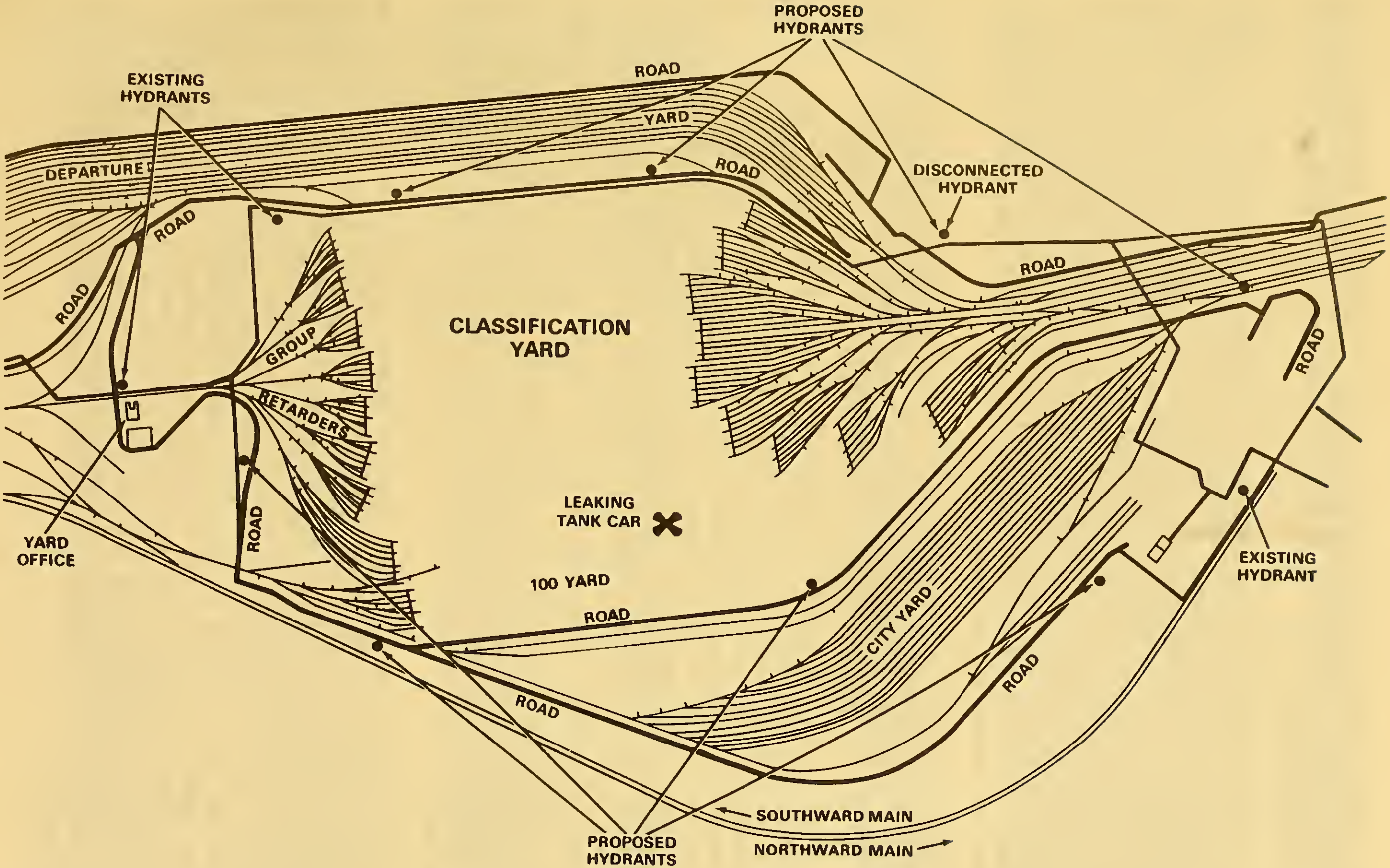


Figure 2.—Sketch of railroad yard showing tracks, fire water system, and access roads in relation to the leaking tank car.

vapors traveled 165 feet from the tank car. A dike of earth was constructed by the railroad to contain the liquid ethylene oxide and the railroad directed the fire department to apply aqueous film forming foam (AFFF) using water from a fire engine tank to reduce the chemical's vapors.

At 6:40 a.m, local MoPac officials advised the State Headquarters of the Arkansas Office of Emergency Services (AOES) at Conway, Arkansas, of the situation. The AOES at Conway in turn notified the AOES office at North Little Rock, the Mayor of North Little Rock, the Arkansas State Police, the North Little Rock Police Department (NLRPD), CHEMTREC, Carbide, the Arkansas State Health Department, the Arkansas State Pollution Control and Ecology Department, and the Red Cross. The Red Cross was requested to locate shelter should evacuation of nearby area residents become necessary. The local AOES served as liaison between the mayor's office and the responding agencies. Local MoPac officials notified its corporate headquarters in St. Louis, Missouri, the AAR Bureau of Explosives, CHEMTREC, Thompson Railroad Salvage, Hulcher Emergency Railroad Services, and the National Response Center which, in turn, called the Safety Board and the Federal Railroad Administration.

Due to the inclement weather, aircraft could not use the Little Rock Airport. Out of town response personnel who were traveling by air were forced to land at Pine Bluff, Arkansas, and drive to the yard, a distance of 47 miles. MoPac personnel from St. Louis arrived on scene at 12:30 p.m., and representatives of Carbide arrived on scene at 2 p.m.

At 3:15 p.m., on December 31, 1984, in anticipation of the arrival of equipment to transfer the remaining ethylene oxide from tank car RAIX-7033, and concern about the tank car rocketing should ignition occur, MoPac officials requested responding State and local emergency agencies to expand the evacuation zone to include the area within 1 mile of the accident site. All rail and highway traffic was halted, with the exception of traffic traveling on Route 67-167 in the extreme northwest quadrant of the zone, and persons were evacuated from houses, apartments, warehouses, retail outlets, and light industry. The Red Cross and MoPac provided the evacuees temporary facilities, food, and blankets. An estimated total of 2,500 person were evacuated from their residences and businesses.

Amtrak's passenger trains were stopped at Jacksonville, and Bald Knob, Arkansas, and the passengers were transported by highway to Little Rock and Texarkana, Arkansas. Inbound freight trains that could not be diverted around the yard by way of MoPac or the St. Louis Southwestern Railway were stopped on the main track. Outbound freight trains were cancelled. The Arkansas State Police blocked off that part of Interstate Highway 40 that was in the evacuation zone, resulting in a major traffic jam due to the high volume of holiday traffic.

MoPac constructed a temporary grade crossing and roadway in the classification yard so that fire department personnel could position their equipment within 400 feet of the leaking ethylene oxide tank car. At 6:30 p.m., using water on board a fire engine, firefighters again applied AFFF to the area around the leaking tank car to reduce the possibility of igniting the ethylene oxide. With each repeated application of AFFF, it was necessary for the fire engine to leave the classification yard to refill its tank with water and return. AFFF was provided by the Little Rock Fire Department, the local Veterans Hospital, the Little Rock Air Force Base at Jacksonville, Arkansas, and other sources; however, some of the AFFF was not used and later was returned. About 8 p.m., the wind direction changed, requiring MoPac to construct another road so that the fire department could position its equipment up wind of the leaking tank car. Fire equipment was difficult to move within the classification yard because the equipment had to be driven down a track straddling one of the rails. In the meantime, the cars on the tracks adjacent to tank car RAIX-7033 were removed and an empty ethylene oxide tank car was placed near the leaking tank car.

The DSI tractor-semitrailer with a pump and hose arrived on scene about 5:45 p.m. and the tractor-semitrailer was placed on a rail flat car and moved near the leaking tank car to be used to transfer the remaining ethylene oxide. However, an inspection of the hose revealed that it was contaminated. Polyvinyl chloride (PVC) pipe was used to connect the liquid off-loading line on the leaking tank car to the intake on the pump, the discharge on the pump to the liquid off-loading line on the empty tank car, and the vapor valve on the leaking tank car to the vapor valve on the empty tank car. The pump was driven by a shaft attached to the power takeoff on the transmission of the diesel powered tractor. Persons with self-contained breathing apparatus were positioned at the valves of each tank car and at the pump on the semitrailer. Leaks appeared at the fitting between the PVC pipe and the pump, and the ethylene oxide in the pipe was released. The second attempt to transfer the ethylene oxide was termintated when leaks were discovered at the pump where the PVC pipe was attached to the pump, and the ethylene oxide in the pipe again was released onto the ground. Finally, the PVC pipe ruptured while being pressure tested, releasing more ethylene oxide. As a result, the transfer effort was temporarily abandoned.

On the morning of January 1, 1985, Hulcher Emergency Railroad Service, an independent contractor hired by MoPac responded to the accident and connected a stainless steel hose to the tank car; the remaining ethylene oxide was transferred to the waiting empty tank car. The transfer was completed at 11 a.m. The evacuation order was rescinded at 11:30 a.m., and residents began entering the area at 11:45 a.m.

Injuries to Persons

There were no injuries.

Damage to Tank Car RAIX 7033

After the ethylene oxide was transferred, tank car RAIX-7033 was purged with nitrogen and an external visual inspection was conducted. The source of the leakage could not be determined because a steel jacket covered the tank. Minor damage to the tank jacket was noted where the jacket was fitted around each tank body bolster.

On January 2, the tank car was transported by rail to Carbide's plant at Taft, where it was flushed with water and drained. An internal visual inspection of the car revealed two through-wall cracks near the center of the bottom of the tank. The internal crack locations corresponded approximately to the extremities of the 9-inch-long welds attaching the anti-shift bracket to the tank shell. The cracks ranged from 2 1/2 to 3 3/4 inches long and were half-moon shaped.

The car then was moved to a railcar repair shop at Texarkana, Arkansas, where it was inspected on January 17, 1985. The tank insulation protection jacket was found to be capable of moving longitudinally along the tank. Two indented areas containing sharp impressions of the ends of the anti-shift bracket were found in the tank shell immediately beyond the extremities of the cracks. A slight out-of-round section was found in the tank near the upper right side of the B-end body bolster attachment which appeared to have been related to previous damage.

Personnel Information

The switchman has been employed by MoPac for 7 years. He was current on MoPac's operating rules and was qualified as a switchman and brakeman. He stated that he had no training related to hazardous materials, including the handling of emergency conditions.

The general car foreman had held his position for 13 years and was in charge of the freight car department, inbound and outbound train inspections, freight car accidents, and incidents including hazardous materials. He stated that he had received in-house hazardous materials training and had attended AAR seminars on hazardous materials.

The yardmaster had held his position for 7 years. He stated that he had not received any hazardous materials training but that he knew how to retrieve hazardous materials information from the computer and that he could determine the hazard of a material in a tank car by the type of placard applied to the tank car.

Railcar Information

Tank Car RAIX 7033.--RAIX 7033 is a DOT specification 111A100W4 tank car built by General American Transportation Corporation (GATX) in January 1976, and specifically designed to transport ethylene oxide. The car is equipped with 100-ton trucks, type F top and bottom shelf couplers, and 1/2-inch full head shields. It is insulated with a 0.65-inch Fiberfrax thermal blanket and 4 inches of fiberglass protected by a steel jacket which is 1/8-inch thick. The jacket was anchored with an anti-shift bracket which was welded directly to the tank shell in violation of 49 CFR 179.200-19(b) which became effective November 6, 1971. (See appendix B) The car is 51 feet 4 1/2 inches long and 15 feet 2 3/4 inches high. The tank has an inside diameter of 108 inches, an inside length of 48 feet, and is fabricated from 7/16-inch ASTM grade A-515-70 steel plate. The tank has a 20-inch manway entrance with an insulated protective housing, three 3-inch angle valves, one gauging device, one safety valve set at 75 psi, one thermometer well, and two 3-inch discharge pipes. The tank has a capacity of 22,003 gallons and was last hydrostatically tested to 100 pounds on November 23, 1981. GATX's Technical Director testified that the company's construction drawings were not updated to reflect the November 6, 1971 change in the DOT tank car safety standards.

Box Car NW 160155.--Box car NW 160155 is a general purpose box car made of steel with a wooden floor, a 20-inch cushion underframe, double plug doors, and is equipped with divided freight braces. The cars outside dimensions are 58 feet 1 inch long, 10 feet 6 inches wide, and 15 feet high. The car has a lightweight of 64,800 pounds and a capacity of 153,000 pounds.

The Accident Site

Five railroad yards constitute MoPac's North Little Rock, Arkansas, automatic retarder classification railroad yard: the Receiving Yard, the Departure Yard, the City Yard, the Bowl Yard, and the One Hundred Yard. The yard is located within the North Little Rock city limits and is surrounded by light industrial buildings, and private residences. (See figure 1.) The Bowl Yard consists of 64 classification tracks which are divided into 8 groups of 8 tracks each. (See figure 2.) The Bowl Yard is bounded on the north by the Departure Yard which has 9 tracks and on the south by the One Hundred Yard, which has 8 tracks, and the City Yard with 14 tracks. The Receiving Yard consists of 9 tracks that are located to the west of the classification tracks. The track designations are numerical. This railroad yard employs the most advance technology in the making up of trains, the classification of freight cars, and the management of information concerning the movement of freight cars and the commodities transported. However, the roads within the yard were not designed to provide easy access to all areas for vehicles during emergencies.

Roads within the yard are located parallel to the northern-most classification track, and the southern-most track in the One Hundred Yard. A 4-inch steel fire water main with a fire hydrant is located across from the northern most classification track about 1,550 feet from the location of the leaking tank car. A fire hydrant is located

at the east entrance to the Yard near Bethany Road, and the estimated distance from the fire hydrant to the area of the leaking tank car is about 1,750 feet. A fire hydrant also is located near the yard office which is about 1,850 feet from the area of the leaking tank car. The distance between the two roads is approximately 1,400 feet.

Meteorological Information

At 4:45 a.m., on December 31, 1984, the time the ethylene oxide release was discovered, the National Weather Service station at Little Rock, Arkansas, recorded drizzling rain with fog, winds from the east at 4 knots, visibility 1/2 mile, and a temperature of 51° F.

During the period of the emergency, intermittent drizzling rain, sleet, fog, and falling temperatures were experienced at the site of the release. Surface winds were very light and shifting in direction.

Emergency Preparedness

At the time of the accident, MoPac's emergency procedures required trainmasters and yardmasters, in the event of a hazardous material leak or fire, to:

(1) Protect all employees: isolate them away from area.

(2) Run a hazardous material trace on the car, and a list of any adjacent tracks to identify any dangerous commodities.

(3) Notify the general car foreman on duty of the location of the emergency, the commodity involved, and require him to make a preliminary investigation using protective equipment if necessary.

In addition, railroad personnel are required to notify, in the following order, the:

General Superintendent
Superintendent
Assistant Superintendent
Master Mechanic
Claim Department
Special Agent
Hazardous Materials and Environment Protection Manager (phone numbers)
CHEMTREC (phone number)
Fire Department - (only if instructed by General Superintendent or Superintendent)

The general superintendent is responsible for all operations of the Eastern District which extends from Chicago, Illinois, to Alexandria, Louisiana, and includes the North Little Rock Terminal Division. His office is located at North Little Rock, Arkansas. The superintendent is responsible for the North Little Rock Terminal Division and his office also is located at North Little Rock Arkansas.

The terminal superintendent of operations had been promoted and transferred to North Little Rock about a year before the accident. He had participated in the development of an emergency plan for the Houston Belt and Terminal Railroad, and had drafted a "Proposed Emergency Response Plan for Missouri Pacific Railroad Company, North Little Rock Terminal Division." The draft plan was designed to provide a specific, uniform, and official means to deal with emergencies involving hazardous materials in the

North Little Rock Railroad Yard. The draft plan listed notification procedures and yard actions for three categories of hazardous materials spills as well as for fires.

At the time of the accident, the draft plan had not been coordinated with fire department officials at North Little Rock; however, the fire department chief and fire marshal were aware of the draft plan. The fire marshal stated that he had reviewed the plan and had discussed it with local railroad officials. Although the preface of the proposed plan contained a provision for the use of a fire department hazardous materials response team in handling emergencies, such a team had not been formed at the time of the accident. The district chief and fire marshal stated that the firefighters were not trained to responed to hazardous materials releases.

The fire department's equipment was designed to deal with fire in city structures and personnel were trained in the suppression of structural fires. The City of North Little Rock maintains an Emergency Operations Plan in compliance with the State of Arkansas Emergency Act 511 of 1973. The plan consists of a basic plan and ten annexes which list the responsibilities by city department function, i.e. fire, police, and communications.

Tests and Research

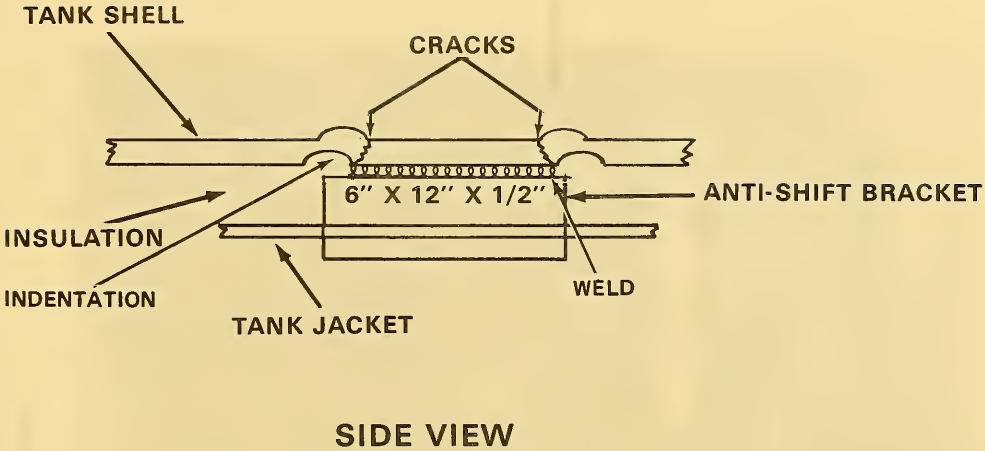
Metallurgists from Carbide and the Safety Board removed a section of the tank shell for metallurgical examination. The section included two through-shell cracks, two indentations, a section of the tank shell bottom plate longitudinal reinforcing bar, the anti-shift bracket, and part of the jacket that was attached to the anti-shift bracket. (See figures 3 and 4.) The metallurgical examination was conducted by a metallurgical consultant in Houston, Texas, under the supervision of the Safety Board's metallurgist.

The metallurgical consultant's report included the following findings:

> Microscope examination of the opened through shell cracks showed a "woody" fracture face. The origins were shown to be at the under cut at the toe of the weld nugget (shell side) on each side at each end of the vertical fin. The weld nugget was much larger on one side. Both sides of both ends of the weld nuggets contained "old" fractures. Also, the final fracture phase of each crack was mechanically damaged.
>
> Scanning electron microscopic examination of the fracture faces that were opened for examination revealed a ductile tensile overload mode for both the "A" and "B" samples. The "woody" morphology was very evident for both samples. It was also evident that the initial fracture was much older than the final through wall fracture area. The initial cracks were all initiated in the undercuts that were located at each nugget toe on the shell side. Some final fracture areas showed evidence of mechanical damage. The old fracture areas were easy to identify by the degree of corrosion that was present with respect to the recent fractures.

The report concluded that "The propagation of the final fracture was a one event single tensile load of unknown origin."

An independent metallurgical consultant retained by MoPac concluded that:



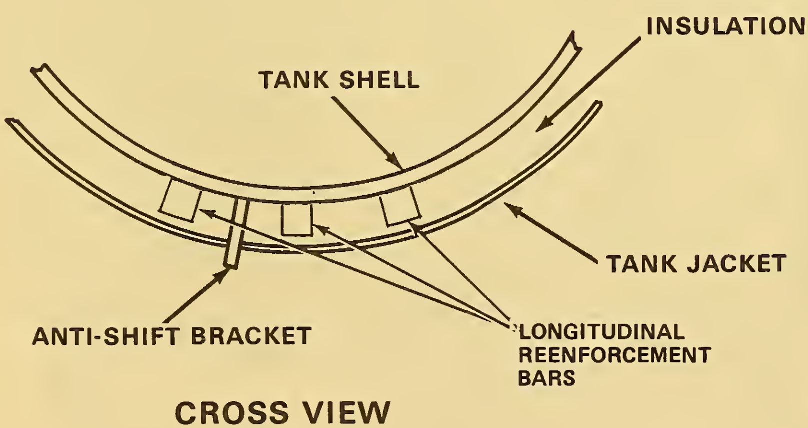


Figure 3.--Sketch of tank car sample area.

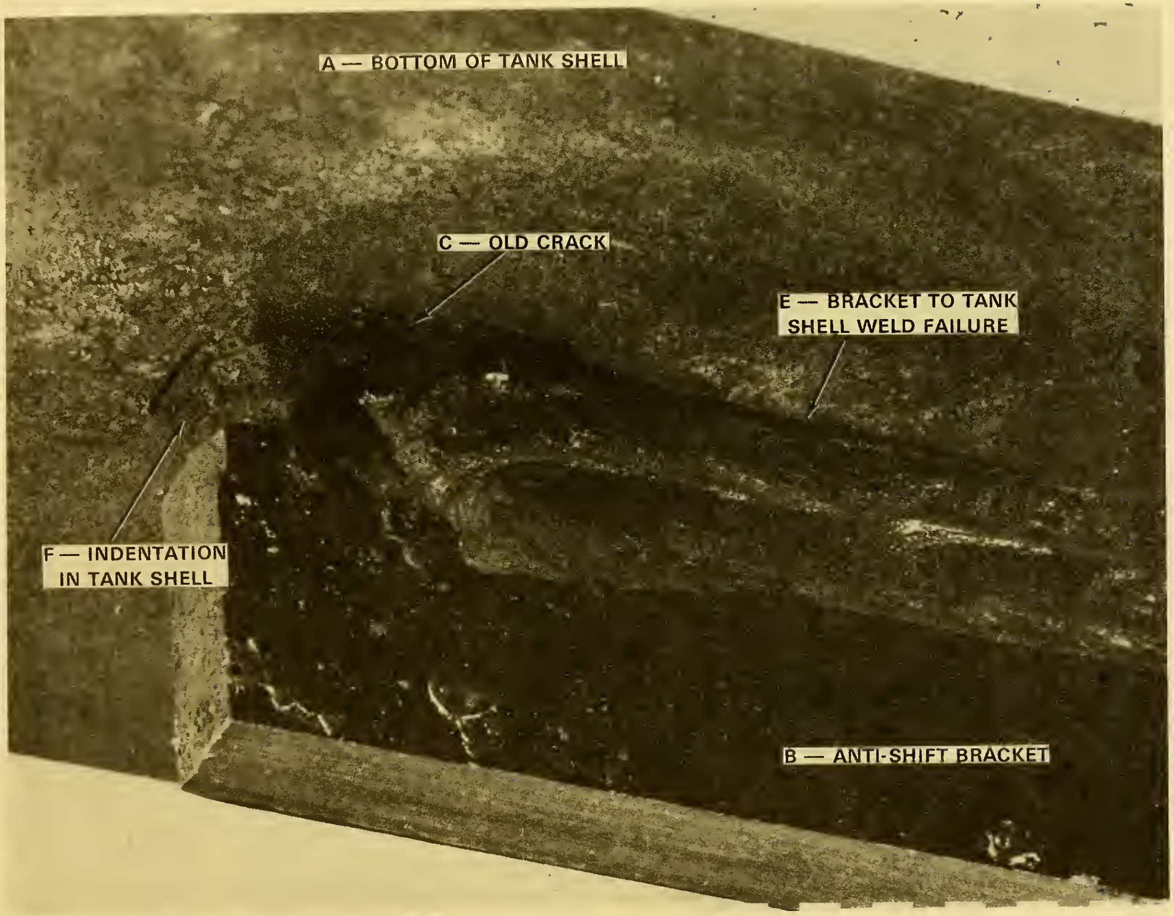


Figure 4.—Photograph of anti-shift bracket.

(1) The progression of the cracks at the toe of the fillet weld to shell indicates that the cause is plastic-hinge (repeated) tensile stress. The progression is in an inward shell thickness direction, that is not preferential to Heat Affected Zone (HAZ), except at the geometric induced starting point. The opening up of inclusion sites on both sides of the cracks clearly indicates tensile crack-opening stress due to hinge point rotation of repeated type.

(2) There is no evidence from the details of the crack-advance features that a single tensile load was involved. In fact, the evidence is that the microscopic details of cracking could not have been developed by single tensile load.

(3) The cracking mechanism is deduced to be of low-cycle 4/ fatigue type. The exact number of tensile stress cycles is not known. However, low cycle fatigue cracking is normally related to be a fatigue spectrum involving significantly less than 1,000 cycles. The "woody" dimpled tearing action of the low cycle fatigue steps does not leave striations which are normally observed for the high cycle fatigue case. High cycle fatigue normally involves 500,000 to 2,000,000 cycles.

(4) The penetration of the shell at the two ends of the fillet welds to shell connection is due to a progression of low cycle fatigue crack from A and B ends of the vertical bracket. The sites that developed the first cracking were the sites of first complete penetration. The low cycle fatigue cracking mechanism is consistent with the type of final penetration of shell.

(5) The hypothesis that single tensile load caused the two shell penetration sites is not tenable. In order for such a concentrated "cut" to develop, it is necessary to grossly deform the surrounding metal. There is no evidence of such deformation.

(6) The sharp dent and concave depressions on the shell by the bracket ends indicate single or repeated compressive cycles. These cycles did not contribute significantly to the crack-opening conditions cited for the fatigue cracking.

(7) These observations of cracking mechanisms indicate that cyclic tensile and compressive stresses were developed at A and B ends. Because of the stiffness of the bracket, it is indicated that the stress action at the A and B ends was of opposite sign (+ or -) for any given time.

4/ The term "high and low cycle fatigue cracking" typically denotes two progressive cracking modes that differ in the number of times a stress is applied and the magnitude of that stress. In other words, high cycle fatigue implies a very large number of stress cycles (typically greater than 1,000,000) but at a relatively low stress magnitude, such as those encountered by a rail car during normal transportation from track irregularities, switching operations, and slack action within the train. Low cycle fatigue, on the other hand, is almost a progressive overstress phenomenon where a few, but very high stress loads cycles, are applied to components, such as in an overspeed coupling.

(8) The cyclic stress system (spectrum) described above indicates a very complex action of jacket forces acting on the anti-shift bracket. A force system of wide variety is indicated.

Other Information

Ethylene Oxide.--Ethylene oxide is a clear, colorless, volatile liquid with an ether like odor. It is used in the manufacture of other chemicals, such as fumigants, rocket propellants, ethylene glycol (anti-freeze), and industrial sterilants. It is toxic and can be fatal at concentrations as low as 0.5 percent in the air, well below its lower flammable limit. Ethylene oxide changes from a liquid to a vapor at temperatures above 50° F, if not under pressure. It has a flash point of less than 0° F and is flammable over a wide vapor-air concentration range. The material has to be diluted at a ratio of 24 parts water to 1 part ethylene oxide before the liquid becomes nonflammable. If contaminated, the volative liquid may polymerize 5/ violently, resulting in the evolution of heat, and it may rupture its container. Its vapors may burn inside a container. Exposure to ethylene may cause irritation to the eyes, the skin, and the respiratory system, and prolonged contact with the skin may result in delayed burns. Prolonged exposure to ethylene oxide deadens a person's ability to detect its odor. Ethylene oxide is lighter than water, and is soluble in water, and its vapors are heavier than air. In 1983, 5,500,000 pounds of ethylene oxide were manufactured in the United States making it the twenty-fourth highest volume chemical produced.

Postaccident Inspection of Similar Tank Cars.--In addition to RAIX 7033, Carbide operates 28 tank cars which carry ethylene oxide and were built by GATX to the same design specification. Immediately after the accident, Carbide removed the tank cars from service. The inspections conducted by Carbide revealed that cracks were being formed in the same area in other tank cars.

Carbide surveyed its fleet of tank cars and discovered an additional 190 tank cars which were not in ethylene oxide service. The tank cars were built by GATX and had a similar type of anti-shift bracket as that installed on RAIX 7033. The tank cars were removed from hazardous materials service and inspected. The inspection revealed that none of these tank cars had cracks. None of the tank cars were equipped with head shields as part of the jacket, and all had bottom outlets and other bottom discontinuities that helped to prevent the jacket from shifting.

Federal Regulation Governing Tank Car Design and Construction.—Under 49 CFR 179, the FRA delegates to the Secretary, Mechanical Division of the AAR, the authority to approve applications of designs, materials, and construction, or alteration of tank car tanks under the specification listed in Part 179. The regulation states, in part, that "compliance is the responsibility of the tank builder. . . and. . .marking the tank with the DOT specification shall be understood to certify compliance.

ANALYSIS

Release of Ethylene Oxide

The deformation patterns and contact marks on the tank shell in the anti-shift bracket area indicated contact between the unwelded extremities of the bracket and the tank shell as if the tank car had been longitudinally deformed (bent) around the length of the anti-shift bracket. This contact would produce through thickness tensile stresses in

5/ Polymerization--A chemical reaction in which a large number or relatively simple molecules combine to form a chain-like giant molecule and in so doing expand greatly.

the tank shell adjacent to the ends of the anti-shift bracket-to-shell weld beads. When these tensile stresses were combined with the stress-concentrating effects of the preexisting cracks and the weld bead undercutting, cracks were formed in the heat affected zone adjacent to the welds.

In the early 1960's, tank car manufacturers began to build tank cars without continuous, full length center sills. Many of the appurtenances that once were attached to the center sill had to be relocated. Some were attached directly to the tank car shell and, in many cases, when a force was applied to the appurtenance, the tank shell would tear and release the commodity. Recognition of this deficiency by the FRA resulted in the enactment of 179.200-19(b) (See Appendix B).

All parties to the Safety Board's investigation agreed that the anti-shift bracket was not installed in accordance with Federal requirements and that cracks existed in the tank shell that predated the release; however, there was disagreement as to the cause of the final failure of the tank shell. One view is that the failure was caused by a single event, such as an overspeed coupling; however, the fact that other tank cars had cracks of varying depths which had not yet propagated through the tank shell discounts the single event theory. The Safety Board believes that it is more likely that the failure developed over a period of time in routine railroad operations, which may have included overspeed couplings, resulting in progressive cracking. Because of the way the anti-shift brackets were installed, tank car RAIX 7033 and others so designed were prone to failure as a result of forces in normal operations dependent primarily upon the type and extent of service for which they were used.

In this accident, ethylene oxide was released through the through-shell cracks caused by the improper attachment of the anti-shift bracket directly to the tank shell. Additional quantities of ethylene oxide were released to the environment during Carbide's unsuccessful attempts to transfer the volatile liquid from the leaking tank while using a makeshift piping system. The later actions increased the hazard to the public and emergency response personnel during the emergency.

Postaccident Inspection of Similar Tank Cars

At the request of the Safety Board, GATX reviewed its records of tank cars constructed using its original anti-shift bracket design. GATX reported that since 1971 more than 9,810 tank cars have been constructed with the anti-shift bracket welded directly to the tank shell. GATX estimated that 50 percent of the 9,180 tank cars to be retrofitted were in hazardous materials service. On April 9, 1985, GATX received approval from the Association of American Railroads' Tank Car Committee to retrofit the tank cars to comply with 49 CFR Section 179.200-19(b), and the tank car owners were notified. The retrofit program includes (1) cutting off the bracket, (2) grinding smooth the area on the shell where the existing bracket was attached, (3) installing a new bracket so that it is not welded directly to the tank shell, (4) inspecting the area where the old bracket was located using a dye penetrant, and (5) correcting any defects found in the tank shell. GATX estimates that 280 cars will be retrofitted each week until the program is complete.

Because it believed that an independent evaluation should be made of the adequacy of the proposed modifications to tank cars with non-complying anti-shift devices, the Safety Board recommended on May 17, 1985, that the FRA:

> Require inspection of all jacketed cars in hazardous materials service that have tank car anti-shift brackets protruding outside the tank jackets for indications of jacket shifting or product seepage in the

> anti-shift bracket area, and remove from service all cars that exhibit symptoms of such distress until approved repairs are made. (R-85-59)
>
> Evaluate for adequacy and timeliness, directing changes as necessary, the General American Transportation Corporation's proposed inspection and repair program for bringing tank cars on which anti-shift brackets are welded directly to the tank shell into regulatory compliance, and monitor the completion of the program. (R-85-60)

On August 8, 1985, the FRA responded to Safety Recommendations R-85-59 and -60, that on June 12, 1985, it issued an order requiring that the DOT specification stenciling be removed from all tank cars constructed by GATX which have the anti-shift bracket welded directly to the tank shell. Also, it directed that the cars be removed from hazardous materials service and not returned to hazardous materials service until action has been taken to bring the cars into compliance with Federal regulations. Further, the FRA advised that it is monitoring the retrofit program at approximately 50 AAR certified shops to ensure that repairs being performed are in compliance with DOT and AAR requirements. As of August 1, 1985, GATX had inspected 3,000 of the 9,810 tank cars; 824 were found to be defective.

While its prompt action to remove these tank cars from service is commendable, the FRA has yet to address the adequacy of the method of repair for these tank cars as proposed by GATX and approved by the AAR, and it is not monitoring the adequacy of field repairs made on these tank cars. The State of Louisiana furnished information to the Safety Board based on its inspection of field modifications being made to replace non-complying anti-shift bracket attachments. The inspections indicate that the procedure being used for retrofitting these tank cars may destroy the integrity of the tank shell. For example, heat and/or mechanical damage may occur to the tank shell during removal of the existing bracket with a cutting torch or hammer. Also, the tank shell thickness may be reduced to less than that required by DOT tank car specifications as a result of grinding out surface cracks. Because more than 280 tank cars per week are being inspected, retrofitted, and returned to service using the AAR approved method, the Safety Board urges the FRA to institute, without further delay, the action earlier called for in Safety Recommendation R-85-60.

Tank Car Construction and Inspection

On June 6, 1985, the Safety Board requested that the AAR and the FRA provide the following information pertaining to inspection activities from November 6, 1971, through the end of 1984 at GATX's manufacturing facilities:

1. The scope of each type of inspection.
2. The deficiencies determined by type.
3. The number of inspections by year from 1971 through 1984.

In a letter dated, July 2, 1985, the AAR stated, in part:

> Under the DOT scheme of regulations, neither the AAR nor any other institution is charged with third party responsibility for making inspections of construction or manufacturing of specific tank cars.
>
> The AAR does inspect facilities of car builders and others for a variety of reasons. With specific reference to tank car construction, the AAR has a program under which it inspects and certifies the facilities of tank car builders. These certification procedures and detailed requirements

for AAR approval of facilities for fabrication, assembly, alteration, conversion, repair and associated testing of tank car tanks are contained in Appendix B of the AAR Specifications M-1002, Specification for Tank Cars.

A company applies for certification by submitting the data required in Appendix B, and if the data is found to be in good order, a task group from the AAR Tank Car Committee is assigned to perform an inspection of the facility. This certification inspection is designed to verify the submitted data with respect to welding procedures and qualifications, supervision, quality control, radiography, postweld heat treatment, and other equipment and/or practices employed at the facility. The purpose of the inspection is to provide assurance that the facility has the ability to manufacture tank cars in accordance with published AAR and DOT specifications. Given a recommendation by the task force and subsequent approval by the Tank Car Committee, a facility becomes certified for a period of 5 years, after which time recertification is required.

The Sharon, Pennsylvania (a.k.a. Masury, Ohio) facility of General American Transportation Corporation was certified by the AAR to perform fabrication, repair, conversion, alteration and assembly of tank car tanks in accord with AAR and DOT requirements. The facility, which is no longer in operation, was inspected for recertification purposes on July 7, 1972, June 20, 1977, and September 1, 1982.

During the 1977 inspection it was noted that some welding equipment inventory control numbers were in error, a minor defect that was judged to have no influence on quality levels.

No other deficiencies were reported during any of the inspections. The facility was permanently closed on April 30, 1984.

In a letter dated July 30, 1985, the FRA responded that it performed no inspections of the actual construction of tank cars and that "the functions of Part 179 of 49 C.F.R., are delegated to the AAR's Tank Car Committee."

Although the FRA is the agency mandated to perform the oversight responsibility of tank car construction, neither it nor its delegated agent, the AAR, inspect tank car manufacturer's facilities to determine if the individual tank cars are being constructed in compliance with DOT regulations and AAR Tank Car Specifications. Consequently, the construction of tank cars in compliance with approved tank car safety standards rests solely with tank car manufacturers. The Safety Board believes that an AAR committee, which is composed of industry representatives, such as tank car owners, is not an appropriate group to monitor compliance with Federal standards because conflicts of interest could develop. Therefore, the Safety Board believes that the FRA should inspect a representative sample of tank cars as they are manufactured to assure that the manufacturer complies with DOT Standards.

The fact that the FRA was unaware that GATX had been installing anti-shift brackets improperly between 1971 and 1984 reinforces the need for it to inspect tank car construction. Had the FRA monitored the manufacture of tank cars employing anti-shift devices, visual inspection at the GATX facilities could have detected in 1971 or early 1972 GATX's failure to modify the attachment of the anti-shift device when attachment directly to the tank shell became unlawful, and corrective action could then have been

taken. Furthermore, had the FRA monitored periodically the modifications of tank cars in service, additional opportunities would have been available for early discovery of this attachment of the noncomplying anti-shift devices.

The Safety Board is concerned that the FRA has no involvement in reviewing and approving modifications to tank cars that may affect the continued safety of the tank cars. In this specific case, a committee of the AAR composed of persons with a vested interest in the continued operations of these tank cars performed the only assessment of the modification proposed by the tank car manufacturer to correct an established flaw. For that matter, the FRA was not required to be notified of the modification as it had delegated its approval authority to the AAR.

Emergency Preparedness

At the time of the accident, North Little Rock had no coordinated community/yard emergency preparedness procedures in effect. The lack of such procedures resulted in delayed notification of emergency response personnel (1 hour 38 minutes after the leakage was discovered) and delayed the evacuation of persons in the 1-mile evacuation zone (about 10 hours after the leakage discovery).

Fire department personnel were not familiar with the railroad yard, including its layout, operations, access routes, and firefighting equipment. Further, there was no prior agreement between the fire department, other emergency response agencies, and yard personnel concerning the manner in which emergency management decisions were to be made, the specific emergency response role each was to fulfill, and the emergency response capabilities of each. The fire marshal and the district chief stated that they arrived at the railroad yard expecting railroad officials to tell them what action they were to take. The fact that the fire department was not prepared to respond effectively to an emergency within the yard and was not aware of the insufficient and unmaintained water system within the yard increased the hazard to the public from accidents within the yard.

The fire department, like most all public agencies surveyed in the Safety Board's special investigation report on railroad yard safety, 6/ perceived the MoPac yard as a unique threat to public safety; yet, it had made no special preparations for responding to emergencies in the yard. For example, the fire department had prepared no contingency plan for handling the release of hazardous materials in the yard, it possessed no special or protective equipment required for responding to releases of hazardous materials handled within the yard, its personnel had not been trained in handling hazardous materials releases, and it had made no effort to determine the yard's capabilities or resources and the nature of the hazardous materials moved within the yard. The Arkansas Office of Emergency Services should review indepth the emergency response in this accident and, in carrying out its responsibility for aiding communities in preparing for emergencies, should determine the state of preparedness of other communities located adjacent to yards and work with those communities to correct deficiencies.

MoPac's emergency preparedness planning also was deficient in that it failed to provide adequate safety information or training to its employees in handling hazardous materials emergency response. Without proper protective equipment and without concern for his safety or the potential for igniting the released ethylene oxide, the switchman approached the vapor cloud and entered the area carrying a lantern capable of igniting the released ethylene oxide. Moreover, other potential sources of ignition were not immediately eliminated, and only a portion of the yard initially was closed down. The

---

6/ Special Investigation Report—"Railroad Yard Safety—Hazardous Materials and Emergency Preparedness" (NTSB/SIR-85/02).

switchman reported sufficient information to yard officials to confirm that ethylene oxide was leaking from the tank car at a substantial rate, and yard officials had in their possession information about the hazards of ethylene oxide; yet action to alert and protect the public and railroad employees was not taken based on this information. Instead, MoPac officials called the general car foreman to conduct a verification inspection. These actions demonstrate the need for MoPac to immediately intensify its training of employees for the actions they take during emergency conditions involving hazardous materials.

Also MoPac was deficient in providing prompt notice to the community about the emergency condition. MoPac's logic for not promptly notifying local emergency response agencies of the emergency may have been similar to that expressed by some railroad officials during the Safety Board's special investigation on railroad yard safety. Several railroad officials related their concern about burdening local emergency response agencies and about receiving adverse media attention should they provide notice for each release of hazardous material within the railroad yard. Railroad officials testified that it is normal to experience numerous, but usually insignificant releases of hazardous materials from tank cars because of venting and improper securing by shippers of tank car appurtenances. Although the concerns of railroad officials are recognized by local emergency response officials, none expressed concern about being overburdened; rather, they stated that they would appreciate knowing promptly of such releases of hazardous materials so they could better carry out their responsibility for public safety and also use these opportunities for training response personnel, for becoming more familiar with the railroad yard, and for becoming more knowledgeable about the railroad personnel and yard response capability which they may have to depend upon in the event of a major emergency. One emergency response official stated that through improved coordination and communication between the community and the railroad yard officials, he believed that a means for accomplishing these notifications could be developed such that there would be little potential that the railroad would receive adverse media attention. The Safety Board also believes that improved coordination and cooperation between the railroads and communities can minimize adverse media attention that may result from increased notifications from railroad yards. However, regardless of any increased media attention, it is imperative that railroad yard officials promptly notify local emergency response officials about releases of hazardous materials so that necessary measures may be taken for the protection of the public.

The independent action taken by the terminal superintendent to develop an emergency plan for this yard is commendable. However, this action did not result in the development of a fully effective, coordinated emergency preparedness response plan because it failed to include the community in the initial development stages. As pointed out in the Safety Board's special investigation report on railroad yard safety, "An adequate level of community/railroad yard hazardous materials risk management implies that each entity: will have a clear idea of the risk to the community, will have knowledge of the emergency resources and procedures of the other, and will familiarize the other with their response capabilities and expectations of what is needed to reduce the risk. For all of this to occur, each entity must develop a response capability, tailor parts of it to the specific needs of the other entity, and practice these procedures to the extent possible to identify new needs or to improve upon existing practices. Doing these things only after an accident has occurred means that the opportunity to prevent loss already has been missed."

Since the accident, MoPac has proposed the installation of a 6-inch polyvinyl chloride fire main in the yard. However, the planned improvement of the fire main system leaves several factors unresolved, including an estimation of the quantity of water required during emergencies; the capability of the existing water mains to meet this

demand; and the availability of hydrants near areas where emergency conditions can be anticipated, especially in the classification yard where the distance between fire hydrants would require laying the fire hose across up to 36 railroad tracks. Before these improvements are undertaken, a detailed analysis should be conducted in consultation with the fire department of the fire main needs based on potential emergencies which may occur in the yard.

Although MoPac management now is committed to a policy of developing specific emergency response plans and now has under development a master plan to guide the development of plans for its individual yards, no date for completing either the master or the specific plans has been established. This accident illustrates the need for MoPac to complete this work on an expedited basis.

CONCLUSIONS

Findings

1. Ethylene oxide leaked from the tank car as a result of two through-shell cracks near the center of the bottom of the tank at each extremity of the welds on the anti-shift bracket.

2. The tank car jacket anti-shift bracket was welded directly to the bottom of the tank shell in violation of 49 CFR 179.200-19(b).

3. As the tank car jacket moved relative to the tank during normal operations, cyclic forces were transmitted through the anti-shift bracket to the tank shell.

4. The switchman who discovered the leaking tank car was not familiar with and trained in the hazards posed by the material in the placarded rail car.

5. Makeshift methods used for transferring ethylene oxide from the leaking tank car resulted in additional ethylene oxide being released in the yard, increasing the hazard to the public and emergency response personnel.

6. Neither the Federal Railroad Administration nor its designated delegate, the Association of American Railroads, monitors manufacturers for compliance with Department of Transportation tank car design, standards, and proper construction methods.

7. The Federal Railroad Administration has not acted to review the adequacy of inspection and repair procedures for General American Transportation Corporation's tank cars with anti-shift brackets welded directly to the tank shell.

8. The inspection and repair now being made of General American Transportation tank cars may not adequately identify and correct all existing cracks in these tank cars and, in fact, may result in damage to the tank.

9. At the time of the accident, neither the city of North Little Rock nor the Missouri Pacific Railroad had an emergency preparedness plan in effect for handling emergencies within the railroad yard.

10. Missouri Pacific Railroad Company's North Little Rock, Arkansas, railroad yard fire main system was inadequately designed and maintained.

11. Missouri Pacific Railroad Company's railroad yard design provided inadequate access for maneuvering fire equipment during the emergency thus requiring the construction of temporary grade crossings.

12. No overall command structure existed or was established for coordinating actions of the emergency response personnel.

13. For 1 hour 38 minutes, the city was not aware of the threat to public safety caused by the hazardous situation within the railroad yard because Missouri Pacific Railroad procedures do not foster prompt notification to other than railroad personnel.

14. The low ambient temperatures kept most of the leaking ethylene oxide in a liquid state and in so doing retarded its migration from the area near the tank car.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

--to the Arkansas Office of Emergency Services:

> Develop, in cooperation with the railroads operating in the State and with the Federal Emergency Management Agency, emergency response guidelines for use by communities adjacent to railroad yards that handle bulk shipments of hazardous materials and assist those communities in the development of effective procedures for responding to releases of hazardous materials within railroad yards. The procedures should address, at a minimum, initial notification, identification of key contact personnel, response actions for the safe handling of releases of the various types of hazardous materials transported, identification of the resources to be provided, actions to be taken by the railroad and the community, and emergency drills and exercises. (Class II, Priority Action) (R-85-98)

--to the Missouri Pacific Railroad Company:

> Develop, in cooperation with the communities adjacent to its railroad yards that handle bulk shipments of hazardous materials, a master railroad yard emergency response guideline for use by railroad yard personnel and the communities, and assist the communities in the development of effective procedures for responding to releases of hazardous materials within its railroad yards. The procedures should address, at a minimum, initial notification, identification of key contact personnel, response actions for the safe handling of releases of the various types of hazardous materials transported, identification of the resources to be provided, actions to be taken by the railroad and the community, and emergency drills and exercises. (Class II, Priority Action) (R-85-49)
>
> Using its master railroad yard emergency response guidelines and in coordination with communities adjacent to its railroad yards, develop local emergency and response plans appropriate to the hazards attending the conditions and operations within each of its railroad yards. (Class II, Priority Action) (R-85-50)

--to the Federal Railroad Administration:

Institute an inspection program to verify that tank cars intended to be used in hazardous materials service are manufactured in compliance with Department of Transportation standards. (Class II, Priority Action) (R-85-99)

--to the City of North Little Rock, Arkansas:

Develop in cooperation with the Arkansas Office of Emergency Services and the Missouri Pacific Railroad Company, an emergency response plan for responding to releases of hazardous materials within railroad yards. The plan should address, at a minimum, initial notification, identification of key contact personnel, response actions for the safe handling of releases of the various types of hazardous materials transported, identification of the resources to be provided, actions to be taken by the railroad and the city, and emergency drills and exercises. (Class II, Priority Action) (R-85-100)

Provide fire and other emergency response personnel with training, response guidance, and equipment necessary to deal with releases of hazardous materials within railroad yards. (Class II, Priority Action) (R-85-101)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ G.H. PATRICK BURSLEY
Member

September 4, 1985

APPENDIXES

APPENDIX A

INVESTIGATION

1. Investigation

The National Transportation Safety Board was notified of this accident at 10:10 a.m., on December 31, 1984, by the National Response Center. The Safety Board dispatched a team of investigators from Washington, D. C., to the accident site at 12:10 p.m., on December 31, 1984.

2. Public Hearing

A public hearing was not held. Depositions were taken from witnesses in North Little Rock, Arkansas, on April 23 and 24, 1985 and in Houston, Texas, on April 25, 1985.

APPENDIX B

EXCERPTS FROM 49 CFR

§ 179.1 General.

(e) When this part requires a tank to be marked with a DOT specification (for example, DOT-105A100W), compliance with that requirement is the responsibility of the tank builder. Marking the tank with the DOT specification shall be understood to certify compliance by the builder that the functions performed by the builder, as prescribed in this part, have been performed in compliance with this part.

(f) The tank builder should inform each person to whom that tank is transferred of any specification requirements which have not been met at time of transfer.

§ 179.3 Procedure for securing approval.

(a) Application for approval of designs, materials and construction, conversion or alteration of tank car tanks under these specifications, complete with detailed prints, shall be submitted in prescribed form to the Secretary, Mechanical Division, AAR, for consideration by its Committee on Tank Cars and other appropriate committees. Approvals or rejections of applications, based on appropriate committee action, shall be issued by said Secretary.

§ 179.200-19 Reinforcements, when used, and appurtenances not otherwise specified.

(b) Reinforcing pads must be used between external brackets and shells if the attachment welds exceed 6 lineal inches of ¼-inch fillet or equivalent weld per bracket or bracket leg. When reinforcing pads are used, they must not be less than one-fourth inch in thickness, have each corner rounded to a 1 inch minimum radius, and be attached to the tank by continuous fillet welds except for venting provisions. The ultimate shear strength of the bracket to reinforcing pad weld must not exceed 85 percent of the ultimate shear strength of the reinforcing pad to tank weld.

§ 174.9 Inspection of tank cars.

(a) Each loaded placarded tank car must be inspected by the carrier before acceptance at the originating point and when received in interchange to see that it is not leaking and that the air and hand brakes, journal boxes, and trucks are in proper condition for service.

§ 232.12 Initial terminal road train air-brake tests.

(a)(1) Each train must be inspected and tested as specified in this section by a qualified person at points—

(i) Where the train is originally made up (initial terminal);

(ii) Where train consist is changed, other than by adding or removing a solid block of cars, and the train brake system remains charged;

§ 232.14 Inbound brake equipment inspection.

(a) At points where inspectors are employed to make a general inspection of trains upon arrival at terminals, visual inspection must be made of retaining valves and retaining valve pipes, release valves and rods, brake rigging, safety supports, hand brakes, hose and position of angle cocks and make necessary repairs or mark for repair tracks any cars to which yard repairs cannot be promptly made.

APPENDIX C

ASSOCIATION OF AMERICAN RAILROADS' EMERGENCY RESPONSE INFORMATION FOR ETHYLENE OXIDE

CLASSIFICATION: FLAMMABLE LIQUID
COMMODITY NUMBER IS 4906610

ETHYLENE OXIDE
FLAMMABLE LIQUID, CORROSIVE
UN1040
THERMALLY UNSTABLE

ETHYLENE OXIDE IS A CLEAR, COLORLESS, VOLATILE LIQUID WITH AN ETHEREAL ODOR. IT IS USED TO MAKE OTHER CHEMICALS, AS A FUMIGANT AND INDUSTRIAL STERILANT. IT HAS A FLASH POINT OF LESS THAN 0. DEG. F, AND IS FLAMMABLE OVER A WIDE VAPOR-AIR CONCENTRATION RANGE. THE MATERIAL HAS TO BE DILUTED ON THE ORDER OF 24 TO 1 WITH WATER BEFORE THE LIQUID LOSES ITS FLAMMABILITY. IF CONTAMINATED IT MAY POLYMERIZE VIOLENTLY WITH EVOLUTION OF HEAT AND RUPTURE OF ITS CONTAINER. THE VAPORS MAY BURN INSIDE A CONTAINER. THE VAPORS ARE IRRITATING TO THE EYES, SKIN, AND RESPIRATORY SYSTEM. PROLONGED CONTACT WITH THE SKIN MAY RESULT IN DELAYED BURNS. IT IS LIGHTER THAN WATER AND SOLUBLE IN WATER. THE VAPORS ARE HEAVIER THAN AIR.

- IF MATERIAL ON FIRE OR INVOLVED IN FIRE
  - DO NOT EXTINGUISH FIRE UNLESS FLOW CAN BE STOPPED
  - USE WATER IN FLOODING QUANTITIES AS FOG
  - SOLID STREAMS OF WATER MAY BE INEFFECTIVE
  - COOL ALL AFFECTED CONTAINERS WITH FLOODING QUANTITIES OF WATER
  - APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE
  - USE "ALCOHOL" FOAM, CARBON DIOXIDE OR DRY CHEMICAL
- IF MATERIAL NOT ON FIRE AND NOT INVOLVED IN FIRE
  - KEEP SPARKS, FLAMES, AND OTHER SOURCES OF IGNITION AWAY
  - KEEP MATERIAL OUT OF WATER SOURCES AND SEWERS
  - BUILD DIKES TO CONTAIN FLOW AS NECESSARY
  - ATTEMPT TO STOP LEAK IF WITHOUT HAZARD
  - USE WATER SPRAY TO DISPERSE VAPORS AND DILUTE STANDING POOLS OF LIQUID
- PERSONNEL PROTECTION
  - AVOID BREATHING VAPORS
  - KEEP UPWIND
  - WEAR SELF-CONTAINED BREATHING APPARATUS
  - AVOID BODILY CONTACT WITH THE MATERIAL
  - WEAR FULL PROTECTIVE CLOTHING
  - DO NOT HANDLE BROKEN PACKAGES WITHOUT PROTECTIVE EQUIPMENT
  - WASH AWAY ANY MATERIAL WHICH MAY HAVE CONTACTED THE BODY WITH COPIOUS AMOUNTS OF WATER OR SOAP AND WATER
- EVACUATION
  - IF FIRE IS PROLONGED AND MATERIAL IS CONFINED IN THE CONTAINER EVACUATE FOR A RADIUS OF 5000 FEET
  - IF FIRE BECOMES UNCONTROLLABLE OR CONTAINER IS EXPOSED TO DIRECT FLAME - EVACUATE FOR A RADIUS OF 5000 FEET

*U.S. GOVERNMENT PRINTING OFFICE: 1985-461-136:20043

HE 192.55 .U6 U58s 85/03
Hazardous materials
release, Missouri Pacific
Railroad Company's North
Little Rock, Arkansas,

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20594

Official Business
PENALTY FOR PRIVATE USE, $300

THIRD CLASS BULK RATE
POSTAGE & FEES PAID
NATIONAL TRANSPORTATION
SAFETY BOARD
WASHINGTON, D.C
PERMIT NO G-200

NTSB - 14A (1)
PATRICIA CUHNS
NAT'L EMERGENCY TRAINING CTR.
16825 SOUTH SETAN AVENUE
EMMITSBURG,MD 21727